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TILEC

# TILEC Discussion Paper

# Local loop unbundling in Europe: experience, prospects and policy challenges

28 February 2005

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## **Abstract**

This paper discusses the development of local loop unbundling in telecommunications markets throughout the European Union. In addition, it discusses some challenges for policy and regulation that arise because of unbundling and related technological developments in the markets for fixed voice telephony and broadband Internet access, in particular related to the emergence of packet-switched telephony such as VoIP.

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## **1. Introduction**

A major promise of the liberalization of telecommunications markets was the rollout of local access networks. Somewhat surprisingly however, local network rollout has been rather disappointing, at least in the light of the initial expectations. So far, local network investments have been narrowly targeted, mainly aimed at corporate customers in business districts or metropolitan areas more generally. Residential customers, especially in rural areas, have hardly experienced the rollout of competing local loops to their houses. Accordingly, the former monopolists still have strong positions in the national markets for local access and fixed telephony.

To a certain extent, residential customers benefited from entry made possible by mandated access to incumbents' networks, as in the case of 'carrier (pre)selection' (CS) and 'local loop unbundling' (LLU). Both types of entry allow entrants without their own local networks to reach end-users by purchasing access from incumbents at the wholesale level. Two differences between CS and LLU are that CS requires relatively little investments by entrants, while in order to offer services based on LLU, entrants need to connect to the incumbent's local switches. In terms of required investment levels, LLU-based entry can be seen as an intermediate entry mode between CS and complete facilities-based entry. It should be noted that compared to CS, LLU gives entrants more control over the types and quality of services that they can provide to end-users, since they depend less on the incumbent's facilities.

Whereas CS has been used mainly as a means to offer voice telephony, this turned out to be different for LLU. At first sight, it seems that LLU has failed to give a strong push to competition in markets for fixed voice telephony. Entrants leasing unbundled local lines from incumbents often use it to only offer broadband Internet access based on 'digital subscriber line' (DSL) technology. The types of unbundling that is minimally needed to do so – 'line sharing' and

‘bitstream access’ – prevent entrants from directly offering voice telephony.<sup>2</sup> To offer voice services, entrants traditionally needed a more elaborate type of unbundling (‘full unbundling’), giving them full control of the copper pair.

Because of technological developments, full unbundling no longer is the only way to enable voice services. First, entrants offering DSL-based Internet access using LLU based on line sharing or bitstream access, can offer ‘Voice over DSL’ (VoDSL), a packet-switched technology for voice telephony that can be implemented in combination with broadband Internet access for end-users. Second, consumers with a broadband connection (provided by incumbent or entrants) can install software on their computers, usually in combination with a headset, that allows them to use the Internet as an alternative infrastructure for voice telephony. The latter option is a particular example of ‘Voice over Internet Protocol’ (VoIP). These (and related) developments are important since, despite the limited success of LLU to directly stimulate competition in voice telephony, indirectly IP-based telephony may lead to useful substitutes for switched voice telephony. Even if the uptake of full unbundling (and the supply of voice telephony by entrants using fully unbundled lines) may seem disappointing in several countries, IP-based telephony may drastically change the picture in the coming years.

The regulatory challenges and pitfalls of LLU are well known.<sup>3</sup> No matter how advanced the nature of the regulatory intervention, there will always be a tradeoff between promoting static efficiency through

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<sup>2</sup> Line-sharing and bitstream access enable the provision of broadband Internet access while the incumbent can continue to offer voice telephony over unbundled lines. Both types of unbundling divide the copper pair spectrum so that it can be used both by incumbent and entrant (OECD, 2003a). See also section 2.

<sup>3</sup> For an overview of the main issues, see e.g. *The Economist*, “Untangling the local loop”, Telecoms Survey, Oct. 9th 2003).

competition in the short run, and stimulating dynamic efficiency through inducing entrants to roll out their own networks in the longer run.<sup>4</sup> This tradeoff, a ‘classic’ dilemma in many utility/network sectors, is given an interesting twist though, because of the possibility of IP-based voice telephony. This development is not only important in itself, it may also facilitate competition in telecommunications over different types of networks, such as fixed, mobile and WiFi.

In this paper, we discuss the development of LLU throughout the European Union. We will discuss some countries in more detail, to illustrate specific issues. As a background, section 2 recapitulates the regulatory framework in Europe as it pertains to LLU. Section 3 provides data and country experiences that illustrate the relative success of LLU, both as a direct and indirect way to introduce competition in markets for voice telephony, and as a way to introduce competition in markets for Internet access. Section 4 discusses some challenges for policy and regulation that arise because of LLU and related technological developments. Section 5 concludes the paper.

## **2. Regulatory framework in the EU**

We start by providing some background on the technology of local networks and unbundling. A simplified picture of a telecommunications network consists of local loops that connect subscribers to ‘main distribution frames’ (MDFs), that is, the equipment at the incumbent’s premises related to local switches where LLU is implemented, and a backbone which connects different local switches. The local loop refers to the "physical twisted metallic pair connecting the network termination point at the subscriber's premises

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<sup>4</sup> This presumes that the social gains from network duplication outweigh its social costs.

to the main distribution frame or equivalent facility in the fixed public telephone network" (European Parliament and Council, 2000, p. 4).

Local loop unbundling comes in different versions: full unbundling, line sharing, and bitstream access.<sup>5</sup> With an initial focus on voice telephony, full unbundling was required, as it gives entrants sufficient control of the copper pair to provide voice telephony to their customers. Fully unbundled loops are directly connected from the incumbent's main distribution frame to the LLU operator's equipment – the entrant gets full control of the copper pairs. In contrast, with line sharing, the incumbent remains in control and can still provide (voice) services to consumers, since entrants lease only a part of the copper pair spectrum (the high-frequency, non-voice spectrum, which can be used for broadband Internet access). Hence, shared access loops remain connected to the incumbent's network and consumers continue to receive voice services from the incumbent. The entrant installs splitters at the incumbent's main distribution frame and the subscriber's premises and connects to the shared local loop.<sup>6</sup> Bitstream access is similar to line sharing in the sense that the copper pair spectrum is also shared by the incumbent and the entrant. The difference is that it is the incumbent that provides the ADSL technology and modems; entrants do not have control over the physical line nor are they allowed to add other equipment. Thus, entrants are restricted to supply services designated by the incumbent (usually broadband Internet access).

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<sup>5</sup> In some countries, bitstream access is viewed as being outside the scope of LLU policy. Also, bitstream access has not been introduced in some countries.

<sup>6</sup> Shared access to the local loop is defined as "the provision to a beneficiary of access to the local loop or local sub loop of the notified operator, authorising the use of the non-voice band frequency spectrum of the twisted metallic pair; the local loop continues to be used by the notified operator to provide the telephone service to the public." (European Parliament and Council, 2000, p. 6)

After the liberalization of telecommunications in the EU 15 countries in the beginning 1990's European legislation was initially silent with respect to local loop unbundling. However, in the second half of the 1990s, LLU became an important issue. It was seen as a substitute to facility-based entry in particular in market segments and geographical areas for which an additional access network would be associated with too large economic costs. It was also considered to be an important element in giving network operators, who already invested in a backbone, the possibility to directly access consumers.

In the early days of the liberalization of telecommunications it was left to the member states of the European Union to decide about whether and how to regulate access to the local loop. Some European countries mandated LLU some time before European legislators became active. For instance, in Germany, unbundling has been required since 1996, in Denmark since 1998, and in the Netherlands since 1999.<sup>7 8</sup>

In 2000, that is, before the New Regulatory Framework adopted in 2002, European legislation with respect to LLU came in place: European legislators mandated the provision of unbundled access to the local loop (European Parliament and Council, 2000).<sup>9</sup> The general philosophy behind this regulation was that mandatory access is an effective means to deal with persistent network monopolies, but as it reduces entrants' incentives to innovate and invest in networks themselves, it should be withdrawn as competition becomes sufficiently mature. In particular:

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<sup>7</sup> The type of unbundling may be different across countries. See also section 3.

<sup>8</sup> Clearly, whether demanding LLU access is attractive for competitors very much depends on the terms at which access is offered. We address the pricing of access below.

<sup>9</sup> See also Delgado et al. (2004, p. 170).



"The high cost of duplicating the local access infrastructure is ruling out new market entrants. This is affecting the level of competition, which the Regulation is intended to increase by offering unbundled access to the local loop, i.e. by enabling new competitors to offer high bit-rate data transmission services for continuous Internet access and for multimedia applications based on digital subscriber line technology as well as voice telephony services." (European Parliament and Council, 2000, p. 4)

Mandated unbundling applied only to operators that had been designated by their NRAs (national regulatory authorities) as having significant market power (SMP).<sup>10</sup> Moreover, access prices (the line rentals of the local loop) must be transparent, non-discriminatory, fair, and set on the basis of cost-orientation.

"Costing and pricing rules for local loops and related facilities should be transparent, non-discriminatory and objective to ensure fairness. Pricing rules should ensure that the local loop provider is able to cover its appropriate costs in this regard plus a reasonable return, in order to ensure the long term development and upgrade of local access infrastructure. Pricing rules for local loops should foster fair and sustainable competition, bearing in mind the need for investment in alternative infrastructures, and ensure that there is no distortion of competition, in particular no margin squeeze between prices of wholesale and retail services of the notified operator. In this regard, it is considered important that competition authorities be consulted." (European Parliament and Council, 2000, p. 4)

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<sup>10</sup> "This Regulation mandates unbundled access to the metallic local loops only of notified operators that have been designated by their national regulatory authorities as having significant market power in the fixed public telephone network supply market under the relevant Community provisions" (European Parliament and Council, 2000, p. 4)

To make this happen, NRAs were given the power to intervene in the market. This includes the power to set the price for LLU. Cost-orientation of LLU rental is not further specified but NRAs typically include common cost components and a rate of return on investments for the incumbent (this is also in line with the New Regulatory Framework, see below). In principle, interfering at the wholesale level, in particular with respect to price, is a temporary measure. Indeed, when the local access market is seen as sufficiently competitive, incumbent operators are no longer required to provide access at cost-orientated wholesale prices.<sup>11</sup>

With the approval of the New Regulatory Framework (NRF) in 2002, the European Union has established an updated and broader framework for regulatory interventions.

“In markets where there continue to be large differences in negotiating power between undertakings, and where some undertakings rely on infrastructure provided by others for delivery of their services, it is appropriate to establish a framework to ensure that the market functions effectively. National regulatory authorities should have the power to secure, where commercial negotiation fails, adequate access and interconnection and interoperability of services in the interest of end-users.” (European Parliament and Council 2002)

Similar to earlier legislation, unbundled access of the local loop is a regulatory remedy to deal with dominance (see e.g. Buigues, 2004). If the NRA establishes SMP, it must apply appropriate remedies. This has to be done on the basis of a list of obligations formulated in the

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<sup>11</sup> “When the national regulatory authority determines that the local access market is sufficiently competitive, it shall relieve the notified operators of the obligation laid down [...] for prices to be set on the basis of cost-orientation.” (European Parliament and Council, 2000, p. 7)

Access Directive as part of the NRF (see European Parliament and Council, 2002), related to transparency, non-discrimination, accounting separation,<sup>12</sup> access (unbundled access and resale of facilities), price control and cost accounting. With respect to the latter, high wholesale prices and price squeezes are explicitly mentioned.

“A national regulatory authority may [...] impose obligations relating to cost recovery and price controls, including obligations for cost orientation of prices and obligations concerning cost accounting systems, for the provision of specific types of interconnection and/or access, in situations where a market analysis indicates that a lack of effective competition means that the operator concerned might sustain prices at an excessively high level, or apply a price squeeze, to the detriment of end-users. National regulatory authorities shall take into account the investment made by the operator and allow him a reasonable rate of return on adequate capital employed, taking into account the risks involved.” (European Parliament and Council, 2002, p. 30)

Note that the NRA is not obliged to impose particular obligations. According to several NRAs (e.g. in the Netherlands and Germany), access regulation is typically appropriate, especially in the early stages of competition, when entrants have not yet rolled out alternative infrastructures. With this logic in mind, and in particular, to gradually eliminate distortions in entrants’ make-or-buy decisions, OPTA (the Dutch NRA) designed a wholesale, cost-based price schedule for full

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<sup>12</sup> Ideally, accounting separation allows to track the relevant costs for providing access. “Accounting separation allows internal price transfers to be rendered visible, and allows national regulatory authorities to check compliance with obligations for non-discrimination where applicable.” (European Parliament and Council, 2002, p. 9). However, a full separation of costs is impossible, in particular in the case of line-sharing.

unbundling, with the cost basis starting at historical costs, gradually increasing over a five-year period, to current or actual costs.<sup>13</sup> After this period, KPN would be free to set a commercially determined line rental. The five-year period was viewed as being representative as a minimum recovery period for substantial investments as those needed in the telecoms market.<sup>14</sup> After a delay of one year, the pricing scheme was implemented. Currently, we are approaching the end of year 4. Hence, the level of the line rental is approaching current costs (as planned), but interestingly, the line rental has decreased, due to the fact that the number of lines has been growing and costs can be shared over more lines. It is unclear what will happen after year 5, though, as the outcomes of OPTA's market analyses (as a part of the implementation process of the NRF) are still uncertain.

The European legislator recognizes that short-term competition through mandated access may come at the cost of long-term competition through investments. However, this conflict is not resolved. The Access Directive only states that

“the imposition by national regulatory authorities of mandated access that increases competition in the short term should not reduce incentives for competitors to invest in

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<sup>13</sup> OPTA (1999), in particular § 31. See also OPTA's press release of 19 March 1999. Doyle (2000) discusses the potential commitment problem of this type of regulation.

<sup>14</sup> For an economic analysis supporting this claim that LLU regulation may be needed to stimulate competition, see De Bijl and Peitz (2002 and 2004a). As has been recognized by regulators and the academics alike, regulators have to be aware that LLU regulation may make investments in competing infrastructure unattractive (lease price increases over time and sunset clauses are proposed remedies). In addition, cost-based regulation contains the risk that owners of local access networks make inefficient investment decisions. See also Bourreau and Dogan (2005).

alternative facilities that will secure more competition in the long term.” (European Parliament and Council, 2002, p.9)

Hence, although one of the key questions with respect to LLU regulation is raised, the NRF does not provide any indications how long-term investment incentives in alternative access networks can be maintained even though access prices are regulated.

### **3. Recent developments in local loop unbundling**

So far, it may appear that LLU has failed to give a strong push to competition in markets for fixed voice telephony. Competition is still mainly based on carrier (pre)selection, also known as ‘indirect access’. The percentage of consumers in the 15 pre-accession member states of the EU using direct access, that is, cases in which entrants offer telephony services over their own local lines or unbundled local lines leased from the incumbent, was 6.5% in 2004.<sup>15</sup> Competition through direct access (including own local line, cable and LLU) was most strongest in Denmark (18%), Spain (11%) and the United Kingdom (17%).<sup>16</sup> Table 3.1 depicts incumbents’ market shares by retail revenue in the fixed telephony market as well as the percentages of subscribers using an entrant for direct access in member states of the EU. We observe that in terms of overall retail revenues the incumbent operator’s market share is above 50% in all 25 member states. However, a relatively low market share of the incumbent is not necessarily reflected in a large subscribers’ share using an entrant for direct access. For instance, Austria and Sweden, in which the incumbent with 55% and 54% respectively has the lowest market share in our sample, do have a 5% and 1% subscribers’ share using an entrant for direct access. This means that in these countries there is

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<sup>15</sup> European Commission (2004b), p. 60.

<sup>16</sup> European Commission (2004b), p. 59.

substantial retail-based competition but little infrastructure-based competition (including LLU).

Country	incumbent's market share (%)	subscribers' share using entrant for direct access (%)
Austria	55.0	5.0
Belgium	72.6	6.7
Cyprus	99.9	na
Czech Rep.	na	na
Denmark	63.2	18.0
Estonia	na	3.0
Finland	95.0	5.0
France	74.2	0.5
Germany	68.0	4.0
Greece	85.9	0.0
Hungary	98.8	na
Ireland	83.0	na
Italy	68.0	3.6
Latvia	94.2	0.0
Lithuania	97.1	0.4
Luxembourg	na	0.4
Malta	100.0	0.0
Netherlands	76.0	na

Country	incumbent's market share (%)	subscribers' share using entrant for direct access (%)
Poland	88.7	na
Portugal	88.3	6.0
Slovakia	100.0	na
Slovenia	100.0	0.0
Spain	73.6	11.0
Sweden	54.0	1.0
UK	63.7	16.9

Table 3.1: Incumbent's market share in fixed telephony market (retail revenues, December 2003, data for Germany and Lithuania exclude internet, market shares for Denmark and Portugal by traffic minutes); percentage of subscribers using an entrant for direct access, including fully unbundled connection or with cable access owned by an alternative operator (1 July 2004, Austria, Belgium, Greece, Italy, and Sweden: 31 December 2003). Source: European Commission (2004c), figures 18, 23.

Let us now focus on LLU. Table 3.2 reports unbundled lines supplied by incumbents.<sup>17</sup> Note that this is only a snapshot of the situation in July 2004 because the landscape is changing very rapidly, as broadband access is expanding quickly and NRAs may modify their regulatory policies and decisions.

<sup>17</sup> Note that in several countris there is, in addition, a substantial number of requested unbundled lines which so far have not been supplied (see European Commission, 2004c, p. 73).

It is interesting to note that in several countries, access is of one particular type and other forms do not play a role. This may be due to differences in regulatory decisions. For example, in Germany there are no provisions for bitstream access, and effectively no such lines are available. In Germany almost all lines come as fully unbundled. This is in contrast to, for instance, the Netherlands, where the vast majority of lines is offered as shared access (and bitstream access is also not used). In other countries the vast majority of unbundling is via bitstream access, for instance in the United Kingdom and Belgium.

We observe that the four types of wholesale access, full LLU, shared-line access, bitstream access and simple resale access (the latter type is not depicted in fig. 3.2), play an important role in the EU. The use of line sharing is the most recent phenomenon: the total number of shared-line access increased from 191,500 for the whole EU in July 2003 to 1,168,828 in July 2004 (see European Commission, 2004c, page 65). This reflects regulatory interventions and the increasing importance of broadband services (see below).

Country	supply of fully unbundled lines	supply of shared lines	supply of bitstream access	total supply of unbundled lines
Austria	45,862	18	71,300	117,180
Belgium	4,750	2,635	86,539	93,924
Czech Rep.	10,035	10,247	0	20,282
Denmark	53,602	26,630	56,163	136,395
Estonia	2,652	0	0	2,652
Finland	96,600	31,600	29,500	157,700
France	13,066	717,654	854,205	1,584,925



Country	supply fully unbundled lines	of supply shared lines	of supply bitstream access	of total supply of unbundled lines
Germany	1,627,846	1,141	0	1,628,987
Greece	932	160	21,845	22,937
Hungary	0	0	41,064	41,064
Ireland	305	1,195	10,990	12,490
Italy	697,530	158	750,000	1,447,688
Latvia	0	0	0	0
Lithuania	0	0	2,249	2,249
Luxembourg	2,376	0	0	2,376
Malta	0	0	0	0
Netherlands	39,625	281,504	0	321,129
Poland	0	0	0	0
Portugal	4,845	0	32,525	37,370
Slovakia	0	0	0	0
Slovenia	0	0	911	911
Spain	40,302	2,142	495,966	538,410
Sweden	10,972	87,795	3,200	101,967
UK	7,466	5,949	224,941	238,356
EU total	2,658,766	1,168,828	2,681,398	6,508,992

Table 3.2: DSL unbundling with fully unbundled lines supplied by the incumbent; shared access lines supplied by the incumbent; bitstream access lines supplied by the incumbent; total number (sum) of access lines (July 2004). No data available for Cyprus. Source: European Commission (2004c), p. 73.

We will now look more generally at the deployment of unbundling throughout the European Union. In addition to data provided by the EU, exhibited in table 3.3, we calculated the ratio of the total supply of unbundled lines to the total number of available local lines. This penetration ratio is a measure of the current potential for competition through unbundling in the overall market for fixed telecommunications (broadband Internet access and voice telephony, either directly offered or by means of IP-based technology, offered by entrants without their own local access networks). The reader should keep in mind that country differences can have very different causes. For instance, a high take-up of LLU can sometimes be explained by the absence of alternative local networks (e.g. cable) or differences in the availability of wholesale service (e.g. bitstream access or wholesale line rental).

Country	PSTN local lines (million)	total supply of unbundled lines	agreements with entrants	unbundling penetration (%)
Austria	2.99	117,180	78	3.92
Belgium	4.50	93,924	26	2.09
Cyprus	0.42	na	na	na
Czech Rep.	3.52	20,282	4	0.58
Denmark	2.11	136,395	22	6.46
Estonia	0.43	2,652	7	0.61
Finland	2.73	157,700	0	5.79
France	33.83	1,584,925	32	4.69
Germany	37.50	1,628,987	95	4.34
Greece	5.60	22,937	13	0.41

Country	PSTN lines (million)	local total	supply of unbundled lines	agreements with entrants	unbundling penetration (%)
Hungary	3.60		41,064	18	1.14
Ireland	1.59		12,490	13	0.79
Italy	26.60		1,447,688	225	5.44
Latvia	0.60		na	na	na
Lithuania	0.82		2,249	17	0.27
Luxembourg	0.24		2,376	6	0.97
Malta	0.21		na	na	na
Netherlands	7.80		321,129	25	4.12
Poland	11.12		na	na	na
Portugal	3.99		37,370	11	0.94
Slovakia	1.20		na	na	na
Slovenia	0.70		911	4	0.13
Spain	16.88		538,410	48	3.19
Sweden	5.50		101,967	246	1.85
UK	29.60		238,356	99	0.81
EU total	204.08		6,688,992	983	3.28

Table 3.3: Incumbent's PSTN activated main lines; total supply of unbundled lines by incumbent to entrants (full unbundling, shared lines, and bitstream access); total number of agreements with entrants (full unbundling, shared lines, and bitstream access); unbundling penetration as total supply of unbundled lines by incumbent over incumbent's PSTN activated main lines (July 2004). Source (except the unbundling penetration): European Commission (2004c), p. 73.

Note from Table 3.3 that one of the frontrunners of deregulation, the UK, has one of the lowest unbundling penetrations. Also (implicit from tables 3.2 and 3.3), there is a large variation in the relative

uptake of fully unbundled lines and shared lines across member states. Countries like Germany and Italy show high shares of full unbundling. The Netherlands and Sweden show substantial numbers of line sharing. In Finland and France, line sharing and bitstream access are both important, in roughly equal proportions.

Tables 3.2 and 3.3 both may give the impression of a relatively low level – compared to initial expectations – of unbundled lines by entrants in 2004. According to OECD (2003a), the reason for this slow progress can be found in the detailed requirements related to implementing LLU, which have slowed down actual implementation arrangements. Another reason may be the fact that incumbents have been slow in upgrading their main distribution frames.<sup>18</sup> This type of upgrading by the incumbent is necessary to make unbundling possible. However, the relatively low deployment statistics discussed above pertain to a single year, and hence contain no information on growth rates over time. Actually, the growth rate of LLU deployment has been quite high in some countries. In Germany, for instance, the ratio of unbundled loops to the total number of local loops increased from 0.27% in 1999 to 1.2% in 2001, while in Denmark, it rose from 0.4% in 2000 to 1.0% in 2001.<sup>19</sup> European Commission (2004a) reports an increase of 110% in unbundled local loops (fully unbundled and shared lines) from 1.8 million (mid 2003) to more than 3.8 million (mid 2004) in the 15 pre-accession member states of the EU, which, according to the Commission, can be explained by ‘decisive regulatory action’, in particular related to pricing. A more recent illustration of the promise of a fast take-up of LLU is provided by France. In France, there were more than 1 million unbundled lines (primarily line sharing) in December 2004, which contrasts to 360,000 at the beginning of March 2004, and only 3,000 at the beginning of 2003 (Ofcom, 2004a, b). Overall, initially there has been a slow

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<sup>18</sup> OECD (2003a), Table 8, p. 22.

<sup>19</sup> See data on the ‘unbundled ratio’ in OECD (2003a), Table 3, p. 20.

uptake, but this is not necessarily a failure of regulation and, given the high growth rate, penetration may become much higher in the near future.

To comment further on the growth of unbundling, we provide recent time-series information for the Netherlands. See Figure 3.1 for data on unbundled lines from January 2003 to December 2004. In the Netherlands, line sharing is the dominant type of LLU-access. Bitstream access is not used, while a relatively small number of lines is of the fully unbundled type.

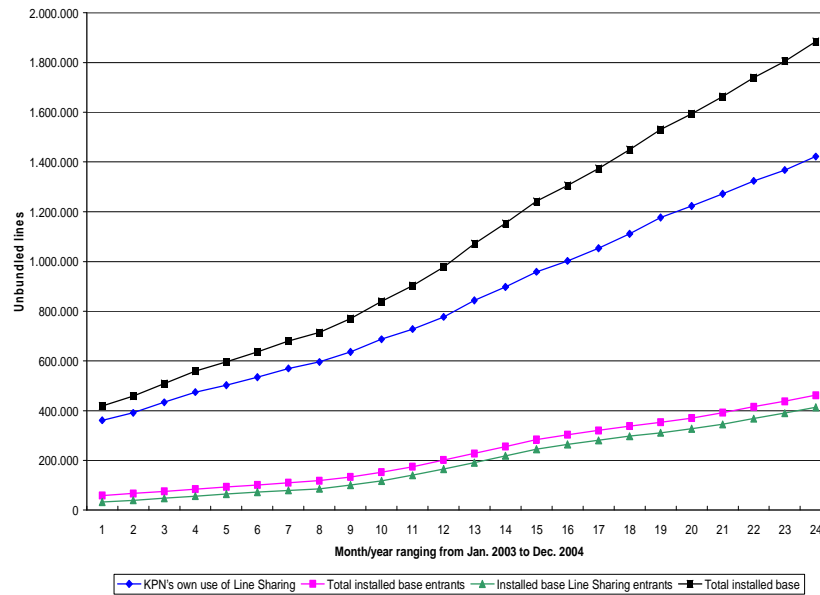


Figure 3.1: Unbundling in the Netherlands in the periods January 2003 - December 2004 (monthly data). Source: OPTA (non-confidential information obtained through private communication).

One can observe from figure 3.1 that over a period of two years, the penetration by entrants using LLU increased from close to zero to more than 400,000 unbundled lines. The figure also illustrates the large gap between the number of ‘unbundled’ lines (a misnomer) used by incumbent KPN itself, in order to offer broadband Internet access as a retail product, and those (i.e., truly unbundled lines) used by its competitors. In absolute terms, this discrepancy has widened during the years 2003-2004: from the underlying data it can be observed that the gap grew from 328,778 in January 2003 to more than 1 million unbundled lines in December 2004, if we restrict ourselves to line sharing. In relative terms, however, this is not the case, since entrants’ share of the total installed base in line sharing increased from 12% to

20%. Nevertheless, KPN still has a strong lead in the broadband Internet access market (if we ignore the position by cable companies, about which the figure does not provide any information). At this moment, it is too early to say anything about the state of competition in the broadband market in the near future, also because it is still uncertain which technologies will exhibit the highest take-up.<sup>20</sup>

Since at least so far, entrants make use of unbundling mainly as a means to offer broadband Internet access, let us now focus more on this type of service in particular. Table 3.5 gives a break-down of broadband retail lines.

Country	incumbent's broadband lines	of which DSL lines	entrants' broadband lines	of which DSL	of which LLU
Austria	249,400	249,400	456,325	106,325	106,325
Belgium	731,825	731,809	712,848	157,485	85,669
Cyprus	14,520	14,490	0	0	0
Czech Rep	30,000	30,000	46,000	6,000	0
Denmark	539,343	427,322	299,807	134,790	134,790
Estonia	51,876	50,780	50,895	126	51
Finland	411,800	306,600	160,300	93,400	93,400
France	2,358,200	2,270,407	2,557,287	2,220,080	1,584,925
Germany	4,704,906	4,700,000	710,341	586,141	586,141
Greece	10,245	10,245	15,686	12,692	12,692
Hungary	111,228	101,197	111,751	41,064	41,064
Ireland	45,360	43,060	20,210	12,490	12,490

<sup>20</sup> In some cities, alternative local broadband networks based on WiFi are constructed as a means to bypass the incumbent's and cable companies' networks.

Country	incumbent's broadband lines	of which DSL lines	entrants' broadband lines	of which DSL	of which LLU
Italy	2,475,881	2,455,802	1,043,916	767,386	766,673
Latvia	27,427	26,815	6,477	0	0
Lithuania	31,986	31,825	56,293	2,249	2,249
Luxembourg	18,630	18,101	6,704	4,027	2,376
Malta	4,511	4,511	9,227	6,915	0
Netherlands	1,053,000	1,053,000	1,319,529	321,129	321,129
Poland	181,501	181,501	10,806	10,806	0
Portugal	530,422	260,341	137,128	37,383	37,383
Slovakia	9,900	9,900	11,785	7,200	0
Slovenia	54,236	52,929	22,103	911	911
Spain	1,536,148	1,535,179	1,231,479	550,993	550,993
Sweden	439,000	434,000	647,167	251,967	101,967
UK	1,117,474	1,114,974	3,278,087	1,638,087	238,356
EU total	16,738,819	16,114,188	12,922,151	6,969,646	4,679,584

Table 3.4: Incumbent's broadband retail lines; incumbent's DSL lines; entrants' broadband retail lines; new entrant's DSL lines; new entrant's DSL unbundled lines (full LLU, shared line, or bitstream access) (July 2004). Source: data reported in or calculated from European Commission (2004c), p. 74.

One can make several observations from table 3.4. Compared to voice telephony (about which we reported earlier), the market for broadband looks much more competitive. In a number of countries, incumbents serve less than half the broadband market. This includes countries with a broadband penetration above the EU average, such as the United Kingdom, Austria, Sweden, the Netherlands, and France.



Note that incumbents mostly offer DSL lines. In a few countries the incumbent also owns a cable operator and offers broadband by means of cable modems (notably in Denmark and Portugal). The type of competition from entrants is heterogeneous across countries. The entrants' access is overall more evenly spread between DSL and other means than for incumbents. At the EU level more consumers subscribe to entrants' DSL lines than to broadband access via other means. The dominating other mean of access is cable. With respect to the entrants' DSL lines, resale of these lines plays an important role only in a small number of countries, most notably the United Kingdom. As can be seen from comparing the last column of table 3.4 with the second column, unbundling access constitutes currently an important role for competition in e.g. Denmark, the Netherlands, France, and Italy, to name a few countries. European Commission (2004c) also provides data on the type of unbundling access for broadband. There, a similar pattern across countries as with respect to the availability of wholesale access, as documented in table 3.2, emerges.

With respect to broadband, we now discuss some country experiences in more detail.<sup>21</sup> Denmark was an early mover with respect to LLU. Fully unbundled lines were mandated in 1998, and line-sharing in 2001. By October 2001 entrants had gained a market share of 44% of DSL lines. A bit more than one year later (December 2002), their market share was down to 21%. Note that this does not imply that a large number of consumers switched back to the incumbent because the total market was increasing fast. However, the incumbent priced more competitively and entrants were no longer able to gain a large share of subscribers. Note also that in Denmark, LLU was not the only way for operators apart from the incumbent to offer broadband services. In addition, broadband is provided by upgraded

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<sup>21</sup> A large part of the information presented below is taken from Ismail and Wu (2003).

cable television networks. Hence competition for the incumbent operator came from facility-based (cable operator Telia Stofa, a subsidiary of TeleSonera) as well as unbundling-based operators (in particular Tiscali and Cybercity).<sup>22</sup>

Belgium also experienced an important role of competition from cable in the broadband market. Actually, it was cable operator Telenet which offered high-speed internet access already in 1997 followed by others in 1998 and 1999, ahead of the incumbent telecommunications operator Belgacom which only started to offer DSL services in 1999. Since almost all households have access to cable and DSL services, facilities-based competition is in place in essentially all geographical areas. In line with European regulation, LLU access was mandated in 2000. By 2002, some ISPs gained a combined 15% share of DSL subscribers through broadband access from Belgacom.

The early success of cable operators in Belgium and partly Denmark contrasts with developments in the same period in Germany. Although also in Germany a large majority of households (86% in 2002) has access to cable; most of these cable networks did not offer high-speed internet access simply because the incumbent telecommunications operator Deutsche Telekom owned most cable networks. Any success in Germany with respect to LLU has therefore to be seen in light of the failure to establish facilities-based competition.

Certainly, the regulated wholesale price, in relationship to actual costs, is an important factor determining different penetration rates in different countries and across different access types. We therefore take a look at wholesale prices and, since we do not have cost data, draw some inferences from the incumbent's retail price. The most relevant price for LLU is the monthly line rental (or lease price) of a local loop

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<sup>22</sup> The other big cable operator is owned by the incumbent telecommunications operator.

charged by the incumbent and which is typically regulated. In addition, there may be co-location costs (e.g. the cost of renting space and power usage in the incumbent's premises) and a one-off cost for a line connection. As outlined in section 2, according to the New Regulatory Framework, the line rental should be cost-oriented. However, 'costs' are open for interpretation. Depending on the country, the line rental may include certain administrative costs, common costs, or costs of refurbishment. Also, the line rental depends on the type of unbundling (full unbundling, line sharing or bitstream access).

Table 3.5 depicts the levels of line rentals and retail subscription fees for the cases of full unbundling and line sharing.<sup>23</sup> As before, also here the international comparisons should be interpreted with caution. For instance, price differences may be caused by differences in service levels.

Country	rental of fully unb. line	average total fully unb. line	cost unb. line	rental of shared line	average total cost shared line	residential subscr. fee
Austria	10.9	15.4		5.5	14.5	15.98
Belgium	11.6	16.3		1.7	6.5	16.80
Cyprus	11.7	17.0		7.3	14.0	9.97
Czech Rep.	15.5	42.0		8.7	na	9.44
Denmark	8.6	12.5		4.3	7.4	16.00
Estonia	8.9	13.7		na	na	6.26
Finland	11.3	25.3		5.7	15.5	11.77
France	10.5	17.1		2.9	9.4	13.00

<sup>23</sup> Data for bitstream access were not available.

Country	rental of fully unb. line	average total cost fully unb. line	rental of shared line	average total cost shared line	residential subscr. fee
Germany	11.8	15.8	2.4	7.5	15.66
Greece	10.4	13.4	5.2	9.1	12.38
Hungary	11.8	24.4	4.3	16.9	12.86
Ireland	16.8	26.9	9.0	19.3	24.18
Italy	8.3	11.6	2.8	7.1	14.57
Latvia	9.0	13.4	4.5	8.9	6.34
Lithuania	12.5	20.4	6.7	16.8	6.66
Luxembourg	15.8	31.3	7.5	23.9	18.40
Malta	na	na	na	na	6.56
Netherlands	9.6	12.0	1.9	5.0	18.16
Poland	Na	na	na	na	9.71
Portugal	12.0	19.0	3.0	10.3	15.07
Slovakia	na	na	na	na	7.39
Slovenia	15.3	21.5	7.0	12.8	10.70
Spain	11.4	13.2	3.0	5.5	15.28
Sweden	11.4	25.3	5.4	15.4	13.75
UK	13.3	24.4	3.4	13.9	16.84
EU average	11.2	17.5	3.3	10.0	14.40

Table 3.5: Monthly line rental of fully unbundled lines; monthly average cost per fully unbundled line; monthly line rental of shared lines; monthly average cost per shared line; monthly residential subscription fee (€, August 2004). Source: European Commission (2004c), figures 76-79, 83.<sup>24</sup>

<sup>24</sup> Monthly average total costs are equal to the monthly rental plus 1/12 of the one-off connection fee. Prices exclude costs of co-location.

Note from table 3.5 that the line rental of a shared line is typically less than half of the price of a fully unbundled line. Related to this observation is the fact that line sharing allows the incumbent to remain active as a supplier of voice telephony, contrary to the case of full unbundling. Furthermore, in some countries (Czech Rep., Estonia, Cyprus, Latvia, Lithuania, Slovenia), the line rental for full unbundling is higher than the retail subscription fee for residential customers. Such a situation, which can be characterized as a ‘price squeeze’, makes it impossible for a LLU-based entrant to make positive profits from (only) selling voice telephony subscriptions to end-users (provided that it would set similar per-minute prices as those charged by the incumbent). Price squeezes seem to become less common, though, because of ex ante regulatory intervention or ex post control by the competition authority. Indeed we do not find indications for a price squeeze in the 15 pre-accession member states of the EU. In particular, the price squeezes in Germany and in the UK, which were present in 2002 (see OECD 2003b, table 6.20, p. 189), have now disappeared.<sup>25</sup>

Clearly, a price squeeze is not very promising for entrants to profitably penetrate the market. However, it would be wrong to conclude that the difference between the incumbent’s retail price and the wholesale price it is allowed to charge for access adequately explains the penetration across countries. A ‘well-behaved’ example is Italy, where the uptake of fully unbundled lines has been quite high, in combination with a relatively low level of the line rental for this type of unbundling. The uptake in Germany, however, seems to be higher than one would expect by considering the level of the wholesale price.

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<sup>25</sup> In 2003, the European Commission fined Deutsche Telekom for eliminating the margin that entrants need to compete for end-users (see the Commission’s press release “Commission fines Deutsche Telekom for charging anti-competitive tariffs for access to its local networks”, IP/03/717, 21/05/2003).

Similarly, some countries with a high take-up of line sharing have had a low line rental (e.g., France, the Netherlands), while others (e.g. Sweden), had known a relatively high wholesale price.<sup>26</sup> Indeed several additional factors, in particular, the availability of alternative direct access, are important to explain cross-country differences.

#### **4. Challenges for policy and regulation**

Most regulatory challenges and pitfalls of LLU are well known. According to *The Economist*:

“How best to promote competition over the local loop is by far the most controversial topic in telecoms regulation. Ideally, competitors would put an end to the incumbents' local-loop monopoly by building their own networks. But building a competing network with the same reach is hugely expensive and time-consuming. [...] over the past few years, most of the developed world has been asking incumbents to share their networks with rivals—technically known as “local loop unbundling” (LLU). This means treating the incumbents as a special case and regulating them in an “asymmetric” way, at least until competing networks have been constructed. By allowing competitors to lease or resell lines, regulators have been able to foster competition in both telephony and broadband access.” (*The Economist*, “Untangling the local loop”, Telecoms Survey, Oct. 9th 2003.)

While LLU-access certainly is a means for entrant to offer direct access, we have seen in the previous section that no simple conclusions from the European experience emerge with respect to the effect of lease prices on competition. Clearly, if LLU is not offered and there are no alternatives for direct access, competition cannot

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<sup>26</sup> See also OFCOM (2004a, b) for cross-country comparisons.

result. Hence, from a short-term perspective regulatory intervention to guarantee direct access at reasonable rates furthers competition. However, when speaking of competition we can mainly have in mind retail prices or the level of market penetration by entrants. The latter seems to us more appropriate because often the lack of competitors is accompanied by retail price regulation, so that the level of retail prices contains little information about the degree of competition. The question then is to which extent LLU lease price regulation affects market penetration. Again, the data presented in the previous section do not give a clear answer. From a theoretical perspective, we would expect that a lease price increase is at least partly shifted to the retail segment. In the extreme case that the entrant does not generate additional demand for subscriptions (so that there are only cannibalization effects as in the case of fixed voice telephony), the theoretical prediction is that a lease price increase translates one-to-one into higher retail subscription fee (see De Bijl and Peitz, 2004b). This implies that lease price regulation is actually neutral to competition in the sense that the market share of the incumbent is not affected and that the entrant is indifferent to the level of the lease price, provided that the total number of subscribers stays the same. This may be a reasonable approximation for fixed voice telephony and implies that LLU is rather ineffective in stimulating competition for voice telephony. Our understanding is that current demand for broadband access by end-users is much more price-elastic. This means that lower broadband prices draw additional consumers into the market. If this is the case, LLU regulation has a stronger impact on penetration by the entrants for broadband than for voice telephony (see De Bijl and Peitz 2004b). Therefore, it seems to us important that regulators explore the difference in regulatory impact between voice and broadband.

Apart from understanding the effectiveness of LLU lease price regulation it is important to understand the direction of LLU-regulation and how it fits into the more general picture of regulation

within telecommunications. There are several reasons why we would like to stress this.

First, suppose for the sake of the argument that narrowband is for voice and broadband for data, and that fixed and mobile telephony are two separate markets. Then with respect to broadband, regulators should ask: do most consumers wish to have fast broadband connections that can increasingly be used for demanding, innovative services, such as movies on demand? Or is there perhaps little need for such advanced products, and do consumers care more for decent speed at low prices? The answer to these questions is of major importance for unbundling policy. To address these questions, the regulator needs to develop an understanding of the preferences of end-users, potentially even about services which do not yet exist. If the answer to the first question, but not the second one, is affirmative, wholesale regulation of the local loop should encourage full unbundling and line sharing and discourage bitstream and simple resale access. However, if the answers are the opposite, then regulation should respond accordingly and, in particular, make bitstream access and simple resale access (e.g. wholesale line rental) available at low wholesale prices.

We should add that the regulatory problem may be somewhat different. It seems likely that entrants will opt for a ‘dual play’ strategy, that is, offering a bundle of voice and broadband Internet access services. In itself, voice may not be sufficiently profitable, but coupled with broadband, it is a means to fully break consumers’ ties with the incumbent. Because of this, it may even happen that there will be a strong increase in the number of fully unbundled lines used by entrants in countries that have so far known an uptake of mainly line sharing or bitstream access, as it allows them to offer such bundles and completely take over end-users. Moreover, the picture becomes more complex as ‘triple play’ may become the nature of the game, consisting of bundles of voice, broadband Internet access and video. In the Netherlands, for instance, incumbent KPN is already



active in the provision of all three services (offering digital TV, as an alternative to cable, by providing an antenna to consumers for a wireless connection).

Second, unbundling is part of the broader issue of infrastructure-based versus retail-based competition. That is, an important question for regulation is whether full network duplication, no duplication of the local access network but investment duplication in technology at the local loop (DSL by entrants), or not even this type of investment duplication, is desirable. Again the answer to this question should depend on the preferences of end-users and, of course, the economic costs for undertaking such investments. The current economic costs depend on general country factors (such as geography, GDP etc.) as well as telecommunications specific factors such as whether cable networks are already in place. In the longer run, infrastructure-based competition is likely to require less regulatory intervention and, therefore, the social costs of regulation appears to be smaller. However, it is not clear whether competition between two (or three) operators with full-access networks (say the incumbent and a cable operator) is seen as sufficiently competitive.<sup>27</sup> If not, even with infrastructure-based competition, regulation may be desirable so that the regulator has to stay active with respect to LLU even in the long run. To summarize, access-based entry modes (LLU and CS) may remain important as means to increase the intensity of competition at the retail level. As a downside, such regulation may reduce investment incentives.<sup>28</sup>

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<sup>27</sup> In several European countries cable operators have partly upgraded their network to offer high-speed internet access (see also Section 3 above). Other networks such as Ethernet LAN are available only for few households in the EU. Hence, without LLU, only one or two operators (the incumbent or incumbent plus one entrant) could offer direct access.

<sup>28</sup> Recall that LLU-regulation of operators with SMP is in general cost-oriented. As mentioned in Section 2, the lease price should include a reasonable return on

Third, the distinction between voice and broadband (for data) is becoming less useful as IP-based voice telephony is gaining ground. An important question for regulators then is how regulation is affected by developments related to IP-based voice telephony (VoIP, VoDSL). Should VoIP be subject to the same regulations as voice telephony? At the time this paper was written, the European Regulators Group (ERG) decided, for the time being, to abstain from intervening at the European level in the IP-based voice telephony.<sup>29,30</sup> The ERG expects that VoIP, if not hindered by regulations (such as those designed for ‘traditional’ telephony services), will lead to strong reductions of price for voice services. Relatedly, cheaper VoIP-based services may have a strong effect on the uptake of broadband Internet access. Interestingly, note that low line rentals for line sharing and bitstream access indirectly facilitate the uptake of VoIP, and hence may act as an accelerator for competition in voice telephony. Clearly, the emergence of VoIP will pose a whole range of regulatory challenges.

Fourth, there is a fundamental way in which VoIP relates to the static versus dynamic efficiency tradeoff. In addition to competition through LLU, wireless local access networks (WLANs), wireless local broadband networks based on the WiFi protocol, and also the third

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investment. Note that innovative and risky new services require a higher rate of return than less risky, less innovative services. This means that even cost-oriented access regulation leaves room for the regulator to decide whether it wants to encourage or discourage infrastructure investments. The regulator simply has to adapt its definition of cost-orientation.

<sup>29</sup> ERG (2005). See also the ERG press release of February 11, 2005.

<sup>30</sup> Exceptions are that the issue of telephone numbers must be technology-independent (so that VoIP-providers cannot use region-independent codes), and that emergency numbers must be accessible through VoIP. NRAs are still free to intervene, so the development of VoIP may follow different paths among member states, if different regulations are applied throughout the EU.

generation of mobile telephony (UMTS), can also help to introduce local competition in the broadband market. Given that these types of networks are packet-switched broadband networks, they can also be used for VoIP-based telephony.<sup>31</sup> Hence, the emergence of VoIP stimulates the growth of different types of ways of reaching end-users. At some point, it may happen that the local access networks of incumbents cease to be the primary way of connecting customers, but just one out of a whole variety of equally effective ways. LLU-regulation has to respond to this type of convergence.

## **5. Conclusion**

Unbundling of the local access network has sometimes been called a failure. Looking at the deployment of full unbundling to allow entrants to (directly) offer fixed voice telephony to their customers, this may indeed be the case. Presumably, the profitability of plain voice telephony is just too low, compared to the total cost associated with leasing (fully unbundled) local lines from an incumbent.

Unbundling, however, has a large potential as a means to offer broadband access to end-users for entrants without local networks. Line sharing and bitstream access are types of unbundling that allow entrants to offer this service, while keeping the incumbent in sufficient control of its local lines so that it can continue to use them to offer voice telephony. The uptake of these forms of unbundling has been relatively successful. Moreover, as VoDSL and VoIP are gaining ground, the intensity of competition in voice telephony can be expected to increase in the near future, despite the ‘failure’ of full unbundling to break open the market for fixed voice telephony.

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<sup>31</sup> For the sake of the argument, here we primarily view UMTS as a local access network for broadband Internet.

Overall, unbundling is likely to lead to more competition in telecommunications services, probably faster than would have happened without regulatory intervention. The question is, however, whether this is good for welfare not only in the short run, but also in the longer run. Does mandatory unbundling create a path for entrants to build up market share quickly during the time that they need to roll out their own networks? Or does it eliminate their incentives to connect end-users themselves? If the latter is true, is this good or bad for welfare? What type of competition, and what type of innovation and variety offered by operators, does society value most? This fundamental question should underly policy and regulation on unbundling. Also, it could be very interesting, as well as important for policy makers, to compare the European regulatory model with a fundamentally different approach, such as the one in South Korea, namely without network-sharing regulation.<sup>32</sup> Overall, despite the fact that there has been a considerable experience with unbundling of the local loop throughout Europe, some fundamental dilemmas and uncertainties still have not been resolved.

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<sup>32</sup> Apparently, in South Korea this has led to fierce facilities-based competition, characterized by substantial investments in fiber-optic cables as well as a fast adoption process, in the Korean broadband market. See “Bringing the Broadband Miracle to Europe”, *The Wall Street Journal*, October 11, 2004.

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